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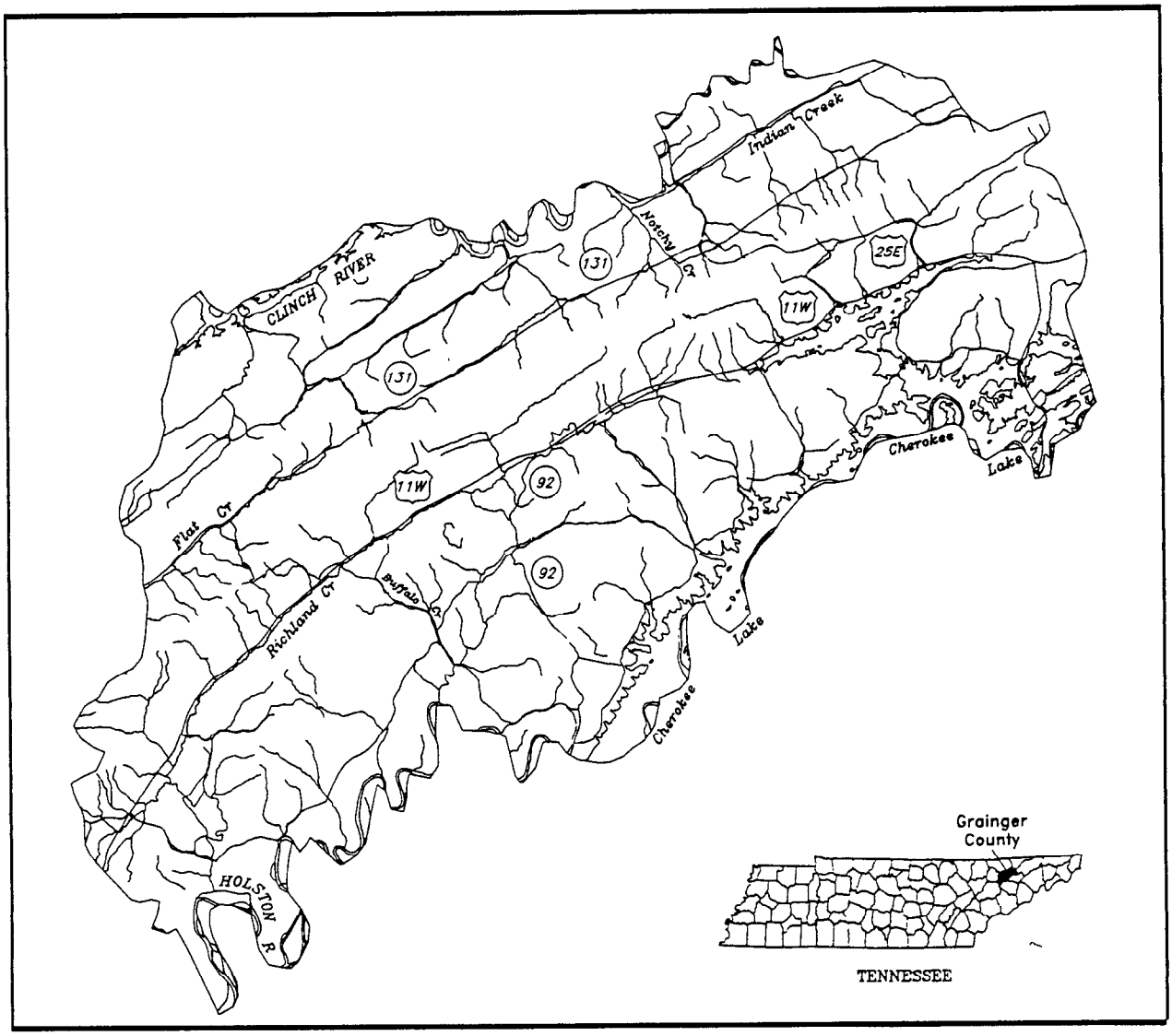
Open-File Report 93-365

Ground-Water Quality for Grainger County, Tennessee



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U.S. Geological Survey

in cooperation with
Grainger County

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Ground-Water Quality for Grainger County, Tennessee

By JESS D. WEAVER, ANANT R. PATEL, and ANDREW C. HICKEY

U.S. GEOLOGICAL SURVEY
Open-File Report 93-365

Prepared in cooperation with
Grainger County

Nashville, Tennessee
1994

U.S. DEPARTMENT OF THE INTERIOR
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Ground-Water Quality for Grainger County, Tennessee

By Jess D. Weaver, Anant R. Patel, *and* Andrew C. Hickey

Abstract

The residents of Grainger County depend on ground water for many of their daily needs including personal consumption and crop irrigation. To address concerns associated with ground-water quality related to domestic use, the U.S. Geological Survey collected water samples from 35 wells throughout the county during the summer 1992. The water samples were analyzed to determine if pesticides, nutrients, bacteria, and other selected constituents were present in the ground water. Wells selected for the study were between 100 and 250 feet deep and yielded 10 to 50 gallons of water per minute. Laboratory analyses of the water found no organic pesticides at concentrations exceeding the primary maximum contaminant levels established by the State of Tennessee for wells used for public supply. However, fecal coliform bacteria were detected at concentrations exceeding the State's maximum contaminant level in water from 15 of the 35 wells sampled. Analyses also showed several inorganic compounds were present in the water samples at concentrations exceeding the secondary maximum contaminant level.

INTRODUCTION

In Tennessee, more than half of the population depends on ground water to meet its daily needs, including personal consumption (Hutson, 1991). Determination of the present ground-water quality in an area provides a basis to assess potential public health risks and suitability of the water for consumptive use and other use, such as crop irrigation. Water-quality determinations also provide data that can be used as benchmarks for determining trends in ground-water quality conditions.

About 75 percent of the residents of Grainger County, Tennessee, depend on private wells for their drinking-water supply (S.S. Hutson, U.S. Geological Survey, written commun., 1993). In addition, wells are an important source of irrigation supply for the vegetable producers of the county. To address concerns associated with ground-water quality in this area, the U.S. Geological Survey, in cooperation with Grainger County, collected and analyzed water samples from 35 wells during the summer 1992 (fig. 1). The main objective of this study was to determine if pesticides, nutrients, bacteria, and other selected constituents were present in the ground water at selected well locations throughout the county.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the contributions of Melinda Turner and Saundra Jarvis of the Clinch-Powell Resource Conservation and Development Council. Their efforts in recruiting volunteers for participation in the well-sampling program was instrumental in the successful completion of this project.

WELL SELECTION CRITERIA

Initially, data for about 500 wells in Grainger County were retrieved from the Tennessee Department of Environment and Conservation, Division of Groundwater Protection, computer data base (Luke Ewing, Tennessee Department of Environment and Conservation, written commun., 1992). The number of well locations was reduced from about 500 to around 100 wells using the following criteria:

(1) Only wells having a depth between 100 and 250 feet were selected.

(2) Only wells having a yield between 10 and 50 gallons of water per minute were selected.

The owners of these estimated 100 wells were asked by representatives of the Clinch-Powell Resource Conservation and Development Council to participate in the study. This process resulted in the selection of 35 wells for sampling at locations distributed throughout the county (table 1). The selected wells are used for domestic supply.

SAMPLE COLLECTION

Water samples from each well were collected after pumping the well until temperature and specific-conductance readings had stabilized. Typically, this process required 20 to 30 minutes of continuous pumping before water samples were collected. The water was withdrawn using the pump already in each well, and the samples were collected at a point prior to the water reaching any residential water-treatment system. Two wells were sampled twice for selected constituents because the original water samples were destroyed during shipment to the laboratory. Equipment malfunctions and high concentrations of particulate matter prevented the measurement of pH and alkalinity in water from a few wells.

RESULTS

The results of the water-quality analyses were compared to the regulations for drinking-water quality established by the Tennessee Department of Health and Environment (1993). These regulations apply to water provided by public water-supply systems and thus are not enforceable for domestic water-supply systems, but the regulations provide a basis for evaluating potential public health risks and assessing the suitability of the water for consumptive use. Primary maximum contaminant levels have been set by the State for the constituents or properties that can adversely affect human health. Secondary maximum contaminant levels have been set by the State for the constituents or properties that only affect the taste, odor, or appearance of the water.

Concentrations of iron (six wells) and manganese (seven wells) exceeded the secondary maximum contaminant level of 300 micrograms per liter and 50 micrograms per liter, respectively (table 2).

Total copper concentrations were greater than the detection limit in six wells (table 2). Nitrite (NO_2) and nitrate (NO_3) concentrations were less than the primary maximum contaminant levels in all of the wells sampled (table 3).

No organic pesticides were present at concentrations greater than primary maximum contaminant levels in any of the 35 wells that were sampled (table 3). Additionally, the occurrences of organic pesticide concentrations above the detection limit of the laboratory were limited to trace amounts of atrazine found at wells 2, 8, and 10, and aldicarb at well 5 (table 3).

Fecal coliform bacteria were detected at concentrations exceeding maximum contaminant levels of 0 colonies per 100 milliliters in water samples from 15 of the 35 wells (table 4). Concentrations listed as less than 1 indicate no bacterial colony content was observed in that particular water sample. In the 15 water samples having detectable fecal coliform, concentrations ranged from 2 to 3,400 colonies per 100 milliliters. The occurrence of bacteria in water samples was scattered throughout the county with no apparent clustering of high concentrations in any specific area.

Additional results from the sampling program indicated the pH of water from well 28 was not within the acceptable range for secondary regulations. Dissolved solids in water from well 26 also exceeded the secondary regulation concentration. Methylene blue, a compound found in many household soaps and detergents, was detected in trace amounts in 23 wells. However, concentrations of methylene blue were less than the secondary maximum contaminant level in all of the sampled wells.

Cation-anion analyses revealed that the most common water type in the county was calcium bicarbonate. However, two exceptions to this general trend were observed:

(1) Water collected from wells located in the middle-southern part of the county was predominantly of the calcium-magnesium bicarbonate type.
(2) Water collected from wells 23 and 34 was dominated by the sodium ion and was classified as sodium bicarbonate.

The concentrations of cations and anions for well 28 were determined to be in error during data verification after the sampling program was completed. This determination was based on a cation-anion ratio percent difference of 48.9 percent. A second laboratory analysis of the sample revealed little improvement in the cation-anion ratio, therefore, the results were deleted from table 2.

Table 1. Well number, latitude, and longitude

Well number	Latitude	Longitude
1	361030	08329580
2	361036	08330050
3	361102	08334520
4	361202	08330370
5	361231	08328240
6	361239	08332570
7	361240	08339140
8	361242	08339560
9	361253	08330170
10	361255	08328280
11	361331	08330200
12	361501	08335130
13	361501	08337170
14	361505	08335280
15	361518	08328510
16	361529	08328580
17	361607	08325150
18	361609	08341170
19	361658	08322200
20	361709	08321560
21	361734	08329010
22	361735	08335190
23	361749	08326360
24	361756	08335340
25	361804	08341090
26	361827	08339070
27	361841	08332530
28	361852	08328430
29	361901	08337060
30	361906	08328410
31	361940	08326330
32	362034	08323070
33	362108	08325470
34	362121	08325240
35	362357	08320010

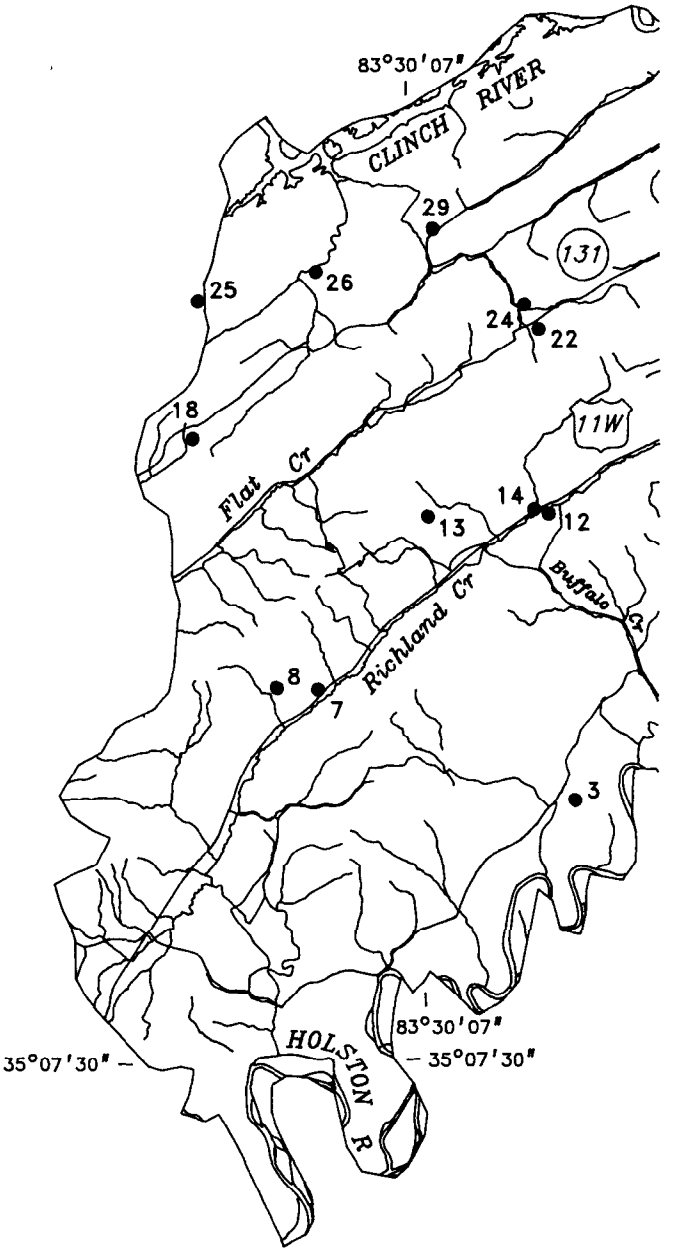
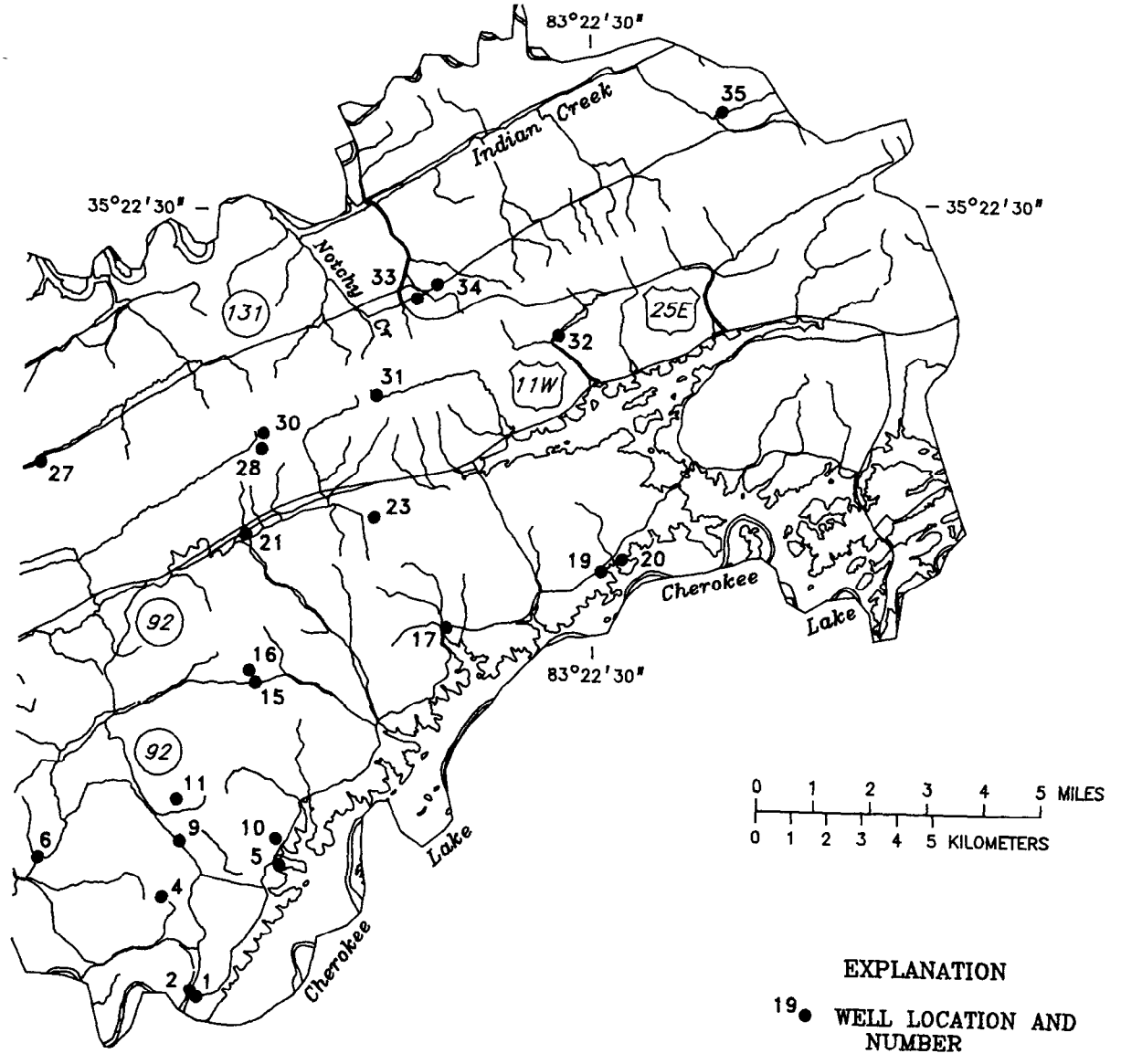


Figure 1. Location of sampled wells in Grainger County.


83°22'30"
35°22'30"
Indian Creek
Notchy Cr
131
25E
11W
92
92
Cherokee Lake
Cherokee Lake
1
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0 1 2 3 4 5 MILES
0 1 2 3 4 5 KILOMETERS
EXPLANATION
19 WELL LOCATION AND NUMBER
Grainger County
TENNESSEE

Table 2. Ground-water-quality data for inorganic compounds

[mg/L, milligrams per liter; µg/L, micrograms per liter; n, constituent or property not regulated; <, less than; --, no data]

Well number	Date	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Sodium adsorption ratio	Sodium (Percent)	Potassium, dissolved (mg/L as K)	Chloride, dissolved (mg/L as Cl)
Maximum contaminant level		n	n	n	n	n	n	250**
1	08-24-92	42	25	1.8	0	2	1	2.1
2	08-27-92	61	38	4.1	.1	3	1.8	7.7
3	09-02-92	47	27	.7	0	1	1.7	.5
4	07-02-92	60	29	1.1	0	1	2.2	--
5	07-07-92	45	25	.9	0	1	1.6	1.5
6	06-26-92	47	26	.8	0	1	1.6	3.2
	07-27-92	--	--	--	--	--	--	--
7	06-26-92	94	14	1.7	0	1	6.7	3.1
8	07-15-92	18	10	13	.6	24	1.7	3.5
9	07-15-92	46	25	1	0	1	1	5.3
10	07-02-92	48	23	.6	0	1	1.5	--
11	08-18-92	41	25	.6	0	1	1.4	1.6
12	08-26-92	86	17	21	.5	14	3.5	12
13	08-24-92	29	8.1	4.7	.2	9	1.2	1
14	07-08-92	71	17	1.8	0	2	2.2	5
15	08-19-92	50	29	1.1	0	1	1.3	5.9
16	08-19-92	58	33	1.4	0	1	1	6.7
17	08-18-92	58	35	4.2	.1	3	2.1	13
18	06-24-92	61	18	5.7	.2	5	4.6	2.8
19	07-09-92	44	24	1	0	1	1.7	5.1
20	07-09-92	48	26	1.2	0	1	1.3	2.3
21	08-17-92	68	35	3.7	.1	2	5.4	7.4
22	07-01-92	110	16	27	.6	15	1.5	33
23	09-02-92	16	6.5	160	9	83	3.3	6.4
24	07-01-92	36	19	.7	0	1	1.3	--
	07-27-92	--	--	--	--	--	--	--
25	08-27-92	36	21	.6	0	1	.9	.8
26	06-30-92	160	14	25	.5	11	1	150
27	06-24-92	89	16	4.7	.1	3	.6	6
28	08-26-92	--	--	--	--	--	--	--
29	06-29-92	90	6.6	1.8	0	2	.8	3.8
30	07-13-92	37	8.3	5	.2	8	1.3	.4
31	08-20-92	26	4.6	.8	0	2	1.1	.9
32	07-14-92	23	5.9	4.5	.2	10	3	9.7
33	08-17-92	90	27	30	.7	16	2.3	16
34	07-16-92	.09	.02	190	150	100	.1	26
35	07-14-92	52	27	1.9	0	2	1.3	2.2

Table 2. Ground-water-quality data for inorganic compounds--Continued

Well number	Date	Sulfate, dissolved (mg/L as SO_4)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Copper, dissolved (µg/L as Cu)	Copper, total recoverable (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L as Mn)
Maximum contaminant level		250**	4*	n	n	1,000**	300**	50**
1	08-24-92	0.9	<0.10	8.2	<10	<10	15	1
2	08-27-92	1.5	<.10	9.6	<10	<10	<3	<1
3	09-02-92	1.3	<.10	11	10	20	<3	<1
4	07-02-92	6.3	.1	11	<10	<10	7	<1
5	07-07-92	2.5	<.10	9.5	<10	<10	7	<1
6	06-26-92	4.1	<.10	13	<10	<10	<3	<1
	07-27-92	--	--	--	--	--	--	--
7	06-26-92	19	<.10	12	<10	<10	43	20
8	07-15-92	14	<.10	26	<10	<10	4,300	130
9	07-15-92	.8	<.10	9.4	<10	<10	5	<1
10	07-02-92	1.9	.1	9.5	<10	<10	<3	<1
11	08-18-92	4.3	.1	8.5	<10	<10	53	<1
12	08-26-92	42	.3	6.5	<10	20	21	67
13	08-24-92	9.2	.2	23	<10	<10	1,900	92
14	07-08-92	4.5	<.10	8.3	<10	<10	<3	<1
15	08-19-92	4.4	.2	9.2	<10	<10	<3	<1
16	08-19-92	6	.4	7.8	<10	<10	<3	<1
17	08-18-92	18	<.10	7.1	<10	<10	<3	<1
18	06-24-92	22	.2	9.5	<10	<10	<3	1
19	07-09-92	3.9	.1	8.9	<10	<10	<3	<1
20	07-09-92	1.8	<.10	9.1	<10	10	<3	1
21	08-17-92	55	.2	10	<10	<10	450	88
22	07-01-92	31	.2	9	<10	<10	190	18
23	09-02-92	47	1.8	11	<10	<10	6	2
24	07-01-92	1.9	.1	9.5	<10	<10	<3	<1
	07-27-92	--	--	--	--	--	--	--
25	08-27-92	2.1	<.10	7.8	<10	<10	<3	<1
26	06-30-92	33	.1	7.9	<10	<10	7	8
27	06-24-92	19	.2	9.4	<10	20	84	27
28	08-26-92	--	--	--	--	--	--	--
29	06-29-92	17	.1	8.8	<10	<10	10	<1
30	07-13-92	16	.2	22	<10	<10	2,000	59
31	08-20-92	17	.3	11	<10	30	4,700	440
32	07-14-92	8.1	.1	10	<10	<10	4,800	400
33	08-17-92	38	.2	8.6	50	60	6	2
34	07-16-92	29	.3	11	<10	<10	<3	<1
35	07-14-92	9.4	.1	8.8	<10	<10	4	<1

* Denotes primary maximum contaminant level.
** Denotes secondary maximum contaminant level.

Table 3. Ground-water-quality data for nutrients and organic compounds

[mg/L, milligrams per liter; µg/L, micrograms per liter; n, constituent or property not regulated; <, less than; --, no data]

Well number	Date	Nitrogen, ammonia dissolved (mg/L as N)	Nitrogen, nitrite dissolved (mg/L as N)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)	Phosphorus ortho, dissolved (mg/L as P)	Perthane, total (µg/L)	Naphthalenes, polychlor, total (µg/L)	Aldrin, total (µg/L)
Maximum contaminant level		n	1.0*	10*	n	n	n	n
1	08-24-92	0.02	<0.010	1.10	<0.010	<0.1	<0.10	<0.010
2	08-27-92	<.010	<.010	3.20	<.010	<.1	<.10	<.010
3	09-02-92	.03	<.010	.92	<.010	<.1	<.10	<.010
4	07-02-92	.02	<.010	2.00	<.010	<.1	<.10	<.010
5	07-07-92	<.010	<.010	1.40	<.010	<.1	<.10	<.010
6	06-26-92	.02	<.010	3.20	<.010	--	--	--
	07-27-92	--	--	--	--	<.1	<.10	<.010
7	06-26-92	.05	<.010	.09	<.010	<.1	<.10	<.010
8	07-15-92	.46	<.010	<.050	.01	<.1	<.10	<.010
9	07-15-92	.28	<.010	<.050	.04	<.1	<.10	<.010
10	07-02-92	.01	<.010	.96	<.010	<.1	<.10	<.010
11	08-18-92	<.010	<.010	.60	<.010	<.1	<.10	<.010
12	08-26-92	.04	<.010	.10	<.010	<.1	<.10	<.010
13	08-24-92	.27	<.010	<.050	.04	<.1	<.10	<.010
14	07-08-92	.01	<.010	.86	.01	<.1	<.10	<.010
15	08-19-92	.01	<.010	2.20	.01	<.1	<.10	<.010
16	08-19-92	.01	<.010	2.30	<.010	<.1	<.10	<.010
17	08-18-92	<.010	<.010	1.30	<.010	<.1	<.10	<.010
18	06-24-92	.02	.01	.15	<.010	<.1	<.10	<.010
19	07-09-92	.01	<.010	1.20	<.010	<.1	<.10	<.010
20	07-09-92	<.010	<.010	.78	<.010	<.1	<.10	<.010
21	08-17-92	.07	<.010	<.050	<.010	<.1	<.10	<.010
22	07-01-92	.09	.03	.63	<.010	<.1	<.10	<.010
23	09-02-92	.04	<.010	.17	<.010	<.1	<.10	<.010
24	07-01-92	.06	<.010	.99	.01	--	--	--
	07-27-92	--	--	--	--	<.1	<.10	<.010
25	08-27-92	<.010	<.010	.22	<.010	<.1	<.10	<.010
26	06-30-92	.05	<.010	.08	<.010	<.1	<.10	<.010
27	06-24-92	.02	.01	.28	<.010	<.1	<.10	<.010
28	08-26-92	.09	<.010	<.050	<.010	<.1	<.10	<.010
29	06-29-92	.02	<.010	3.20	<.010	<.1	<.10	<.010
30	07-13-92	.34	<.010	<.050	.05	<.1	<.10	<.010
31	08-20-92	.05	<.010	<.050	.02	<.1	<.10	<.010
32	07-14-92	.02	<.010	1.20	<.010	<.1	<.10	<.010
33	08-17-92	.04	<.010	.39	.02	<.1	<.10	<.010
34	07-16-92	.01	<.010	.40	<.010	<.1	<.10	<.010
35	07-14-92	.02	<.010	4.10	<.010	<.1	<.10	<.010

Table 3. Ground-water-quality data for nutrients and organic compounds--Continued

Well number	Date	Lindane, total (µg/L)	Chlordane, total (µg/L)	DDD, total (µg/L)	DDE, total (µg/L)	DDT, total (µg/L)	Dieldrin, total (µg/L)
Maximum contaminant level		**0.2***	**2.0***	**n**	**n**	**n**	**n**
1	08-24-92	<0.010	<0.1	<0.010	<0.010	<0.010	<0.010
2	08-27-92	<.010	<.1	<.010	<.010	<.010	<.010
3	09-02-92	<.010	<.1	<.010	<.010	<.010	<.010
4	07-02-92	<.010	<.1	<.010	<.010	<.010	<.010
5	07-07-92	<.010	<.1	<.010	<.010	<.010	<.010
6	06-26-92	--	--	--	--	--	--
	07-27-92	<.010	<.1	<.010	<.010	<.010	<.010
7	06-26-92	<.010	<.1	<.010	<.010	<.010	<.010
8	07-15-92	<.010	<.1	<.010	<.010	<.010	<.010
9	07-15-92	<.010	<.1	<.010	<.010	<.010	<.010
10	07-02-92	<.010	<.1	<.010	<.010	<.010	<.010
11	08-18-92	<.010	<.1	<.010	<.010	<.010	<.010
12	08-26-92	<.010	<.1	<.010	<.010	<.010	<.010
13	08-24-92	<.010	<.1	<.010	<.010	<.010	<.010
14	07-08-92	<.010	<.1	<.010	<.010	<.010	<.010
15	08-19-92	<.010	<.1	<.010	<.010	<.010	<.010
16	08-19-92	<.010	<.1	<.010	<.010	<.010	<.010
17	08-18-92	<.010	<.1	<.010	<.010	<.010	<.010
18	06-24-92	<.010	<.1	<.010	<.010	<.010	<.010
19	07-09-92	<.010	<.1	<.010	<.010	<.010	<.010
20	07-09-92	<.010	<.1	<.010	<.010	<.010	<.010
21	08-17-92	<.010	<.1	<.010	<.010	<.010	<.010
22	07-01-92	<.010	<.1	<.010	<.010	<.010	<.010
23	09-02-92	<.010	<.1	<.010	<.010	<.010	<.010
24	07-01-92	--	--	--	--	--	--
	07-27-92	<.010	<.1	<.010	<.010	<.010	<.010
25	08-27-92	<.010	<.1	<.010	<.010	<.010	<.010
26	06-30-92	<.010	<.1	<.010	<.010	<.010	<.010
27	06-24-92	<.010	<.1	<.010	<.010	<.010	<.010
28	08-26-92	<.010	<.1	<.010	<.010	<.010	<.010
29	06-29-92	<.010	<.1	<.010	<.010	<.010	<.010
30	07-13-92	<.010	<.1	<.010	<.010	<.010	<.010
31	08-20-92	<.010	<.1	<.010	<.010	<.010	<.010
32	07-14-92	<.010	<.1	<.010	<.010	<.010	<.010
33	08-17-92	<.010	<.1	<.010	<.010	<.010	<.010
34	07-16-92	<.010	<.1	<.010	<.010	<.010	<.010
35	07-14-92	<.010	<.1	<.010	<.010	<.010	<.010

Table 3. Ground-water-quality data for nutrients and organic compounds--Continued

Well number	Date	Endosulfan, total (µg/L)	Endrin, water, unfiltered, total (µg/L)	Toxaphene, total (µg/L)	Heptachlor, recoverable (µg/L)	Heptachlor epoxide, total (µg/L)	Methoxychlor, total (µg/L)	PCB, total (µg/L)	Mirex, total (µg/L)
Maximum contaminant level		n	0.2*	3*	0.4*	0.2*	40*	0.5*	n
1	08-24-92	<0.010	<0.010	<1	<0.010	<0.010	<0.01	<0.1	<0.01
2	08-27-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
3	09-02-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
4	07-02-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
5	07-07-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
6	06-26-92	--	--	--	--	--	--	--	--
	07-27-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
7	06-26-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
8	07-15-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
9	07-15-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
10	07-02-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
11	08-18-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
12	08-26-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
13	08-24-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
14	07-08-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
15	08-19-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
16	08-19-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
17	08-18-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
18	06-24-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
19	07-09-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
20	07-09-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
21	08-17-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
22	07-01-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
23	09-02-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
24	07-01-92	--	--	--	--	--	--	--	--
	07-27-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
25	08-27-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
26	06-30-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
27	06-24-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
28	08-26-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
29	06-29-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
30	07-13-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
31	08-20-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
32	07-14-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
33	08-17-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
34	07-16-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01
35	07-14-92	<.010	<.010	<1	<.010	<.010	<.01	<.1	<.01

Table 3. Ground-water-quality data for nutrients and organic compounds--Continued

Well number	Date	Atrazine, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Aldicarb, total (µg/L)	Carbofuran, total (µg/L)
Maximum contaminant level		3.0*	2.0*	n	n	40*
1	08-24-92	<0.1	<0.1	<1.0	<1.0	<1.0
2	08-27-92	.2	<.1	<1.0	<1.0	<1.0
3	09-02-92	<.1	<.1	<1.0	<1.0	<1.0
4	07-02-92	<.1	<.1	<1.0	<1.0	<1.0
5	07-07-92	<.1	<.1	<1.0	1.0	<1.0
6	06-26-92	--	--	--	--	--
	07-27-92	<.1	<.1	<1.0	<1.0	<1.0
7	06-26-92	<.1	<.1	<1.0	<1.0	<1.0
8	07-15-92	.1	<.1	<1.0	<1.0	<1.0
9	07-15-92	<.1	<.1	<1.0	<1.0	<1.0
10	07-02-92	.1	<.1	<1.0	<1.0	<1.0
11	08-18-92	<.1	<.1	<1.0	<1.0	<1.0
12	08-26-92	<.1	<.1	<1.0	<1.0	<1.0
13	08-24-92	<.1	<.1	<1.0	<1.0	<1.0
14	07-08-92	<.1	<.1	<1.0	<1.0	<1.0
15	08-19-92	<.1	<.1	<1.0	<1.0	<1.0
16	08-19-92	<.1	<.1	<1.0	<1.0	<1.0
17	08-18-92	<.1	<.1	<1.0	<1.0	<1.0
18	06-24-92	<.1	<.1	<1.0	<1.0	<1.0
19	07-09-92	<.1	<.1	<1.0	<1.0	<1.0
20	07-09-92	<.1	<.1	<1.0	<1.0	<1.0
21	08-17-92	<.1	<.1	<1.0	<1.0	<1.0
22	07-01-92	<.1	<.1	<1.0	<1.0	<1.0
23	09-02-92	<.1	<.1	<1.0	<1.0	<1.0
24	07-01-92	--	--	--	--	--
	07-27-92	<.1	<.1	<1.0	<1.0	<1.0
25	08-27-92	<.1	<.1	<1.0	<1.0	<1.0
26	06-30-92	<.1	<.1	<1.0	<1.0	<1.0
27	06-24-92	<.1	<.1	<1.0	<1.0	<1.0
28	08-26-92	<.1	<.1	<1.0	<1.0	<1.0
29	06-29-92	<.1	<.1	<1.0	<1.0	<1.0
30	07-13-92	<.1	<.1	<1.0	<1.0	<1.0
31	08-20-92	<.1	<.1	<1.0	<1.0	<1.0
32	07-14-92	<.1	<.1	<1.0	<1.0	<1.0
33	08-17-92	<.1	<.1	<1.0	<1.0	<1.0
34	07-16-92	<.1	<.1	<1.0	<1.0	<1.0
35	07-14-92	<.1	<.1	<1.0	<1.0	<1.0

* Denotes primary maximum contaminant level.
** Denotes secondary maximum contaminant level.

Table 4. Miscellaneous ground-water-quality data

[°C, degrees Celsius; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; Col/100 mL, number of colonies per 100 milliliters of sample; K, results based on colony count outside the acceptable range; n, constituent or property not regulated; <, less than; --, no data]

Well number	Date	Temperature, water (°C)	Specific conductance (µS/cm)	pH (Standard units)	Hardness, total (mg/L as $CaCO_3$)	Alkalinity (mg/L as $CaCO_3$)	Solids, sum of constituents, dissolved (mg/L)
Maximum contaminant level		n	n	6.5-8.5**	n	n	500**
1	08-24-92	15.5	384	7.6	210	208	211
2	08-27-92	15.0	581	7.2	310	--	308
3	09-02-92	18.5	422	--	230	--	236
4	07-02-92	15.0	481	7.3	270	242	--
5	07-07-92	15.5	403	7.4	220	215	221
6	06-26-92	15.5	443	7.4	220	222	243
7	06-26-92	15.5	586	7.1	290	306	334
8	07-15-92	14.5	241	7.1	86	102	152
9	07-15-92	15.5	397	7.6	220	212	216
10	07-02-92	14.5	380	7.4	210	200	--
11	08-18-92	15.0	395	7.6	210	208	210
12	08-26-92	15.0	598	7.4	280	284	360
13	08-24-92	15.5	232	7.4	110	106	142
14	07-08-92	16.0	467	7.3	250	283	284
15	08-19-92	15.0	451	7.5	240	231	250
16	08-19-92	16.5	512	7.3	280	271	287
17	08-18-92	14.5	568	7.2	290	270	305
18	06-24-92	15.0	437	7.4	230	212	252
19	07-09-92	15.0	401	7.5	210	214	222
20	07-09-92	15.0	434	7.6	230	232	233
21	08-17-92	15.0	590	7.3	310	266	345
22	07-01-92	15.5	743	7.1	340	330	429
23	09-02-92	17.0	726	--	67	--	483
24	07-01-92	15.0	323	7.6	170	165	--
25	08-27-92	14.0	336	7.8	180	181	179
26	06-30-92	14.0	1,060	7.1	460	311	578
27	06-24-92	14.5	532	7.1	290	278	313
28	08-26-92	15.0	157	6.3	40	219	222
29	06-29-92	14.5	497	7.2	250	230	281
30	07-13-92	15.5	275	7.4	130	131	172
31	08-20-92	15.5	179	6.7	84	75	112
32	07-14-92	16.5	209	6.7	82	82	124
33	08-17-92	16.0	710	7.2	340	340	418
34	07-16-92	16.0	755	7.2	0	362	476
35	07-14-92	15.5	464	7.4	240	227	257

Table 4. Miscellaneous ground-water-quality data--Continued

Well number	Date	Oil and grease (mg/L)	Coliform, fecal (Col/ 100 mL)	Streptococci, fecal (Col/ 100 mL)	Methylene blue active substance (mg/L)
Maximum contaminant level		n	0*	n	0.5**
1	08-24-92	<1	<1	<1	<0.01
2	08-27-92	<1	<1	K2	.04
3	09-02-92	<1	<1	<1	.01
4	07-02-92	<1	280	100	.02
5	07-07-92	<1	K4	K9	.01
6	06-26-92	<1	<1	<1	.02
7	06-26-92	<1	K2	K4	<.01
8	07-15-92	<1	<1	<1	<.01
9	07-15-92	<1	K2	K2	.01
10	07-02-92	<1	K16	K6	.01
11	08-18-92	<1	<1	K2	.02
12	08-26-92	<1	K4	K8	<.01
13	08-24-92	<1	K1	K2	.02
14	07-08-92	<1	K8	K8	.01
15	08-19-92	<1	<1	<1	.03
16	08-19-92	<1	<1	<1	.03
17	08-18-92	<1	K4	K6	.03
18	06-24-92	<1	<1	<1	<.01
19	07-09-92	<1	<1	<1	.01
20	07-09-92	<1	<1	<1	<.01
21	08-17-92	<1	K2	<1	.02
22	07-01-92	<1	K4	25	.02
23	09-02-92	1.00	<1	K1	.01
24	07-01-92	<1	<1	K5	.01
25	08-27-92	<1	<1	<1	<.01
26	06-30-92	<1	3,400	200	.03
27	06-24-92	<1	K4	K4	<.01
28	08-26-92	<1	<1	<1	<.01
29	06-29-92	<1	K4	K8	.03
30	07-13-92	<1	<1	<1	<.01
31	08-20-92	<1	<1	<1	.01
32	07-14-92	<1	<1	<1	<.01
33	08-17-92	<1	42	K1	.03
34	07-16-92	<1	<1	<1	<.01
35	07-14-92	<1	<1	<1	.03

* Denotes primary maximum contaminant level.
** Denotes secondary maximum contaminant level.

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